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Information Memorandum No. MT-81-263
Expires: 9/30/82

To: District Managers

From: Chief, Division of Resources

Subject: Transmittal of Presentations at the Western States Sage Grouse Workshop

Enclosed is a synopsis of papers presented, tour and general comments regarding the above meeting. Please have this distributed to your Wildlife Biologists in your District and Area Offices.

This is an excellent summary of attendance at such meetings. Recognizing our travel is becoming more and more limited, synopses such as this one should be developed for all meetings attended. I am sure you Managers would be interested particularly in the comments section. BLM's wildlife program can be more successful if we are participating in such meetings. I encourage you to send at least one Biologist from your District to important meetings being held in your area. Naturally they would be expected to prepare a synopsis to be shared by all Biologists in our states.

Robert Welch
- Acting

1 Enclosure
Encl. 1-Synopsis

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UNITED STATES
DEPARTMENT OF THE INTERIOR
BUREAU OF LAND MANAGEMENT

NON-GOVERNMENT MEETING ATTENDANCE REPORT

Date of Report September 10, 1981

INSTRUCTIONS

Distribute copies as indicated at lower right-hand corner.
Report must be submitted within two (2) weeks following meeting.

1. Name	2. Title	3. Duty station
Craig Altop	Wildlife Biologist	Dickinson District Office

MEETING

4. Name	5. Place	6. DATES	
		FROM	THROUGH
Western States Sage Grouse Workshop	Bowman, North Dakota	09-01-81	09-03--81

7. Sponsor	8. Attendance expense	9. Report disseminated	10. Consolidated report
North Dakota Game and Fish	[X] Gov't [ ] Personal	[X] Yes [ ] No	[ ] Yes [X] No

11. Nature of participation *(committee, paper, officer, etc.)*

Observer, Tour guide

12. Summary of presentations, resolutions, and information affecting BLM

On September 1,2,3, 1981, the North Dakota Game and Fish Department hosted the Twelfth Western States Sage Grouse Workshop in Bowman, North Dakota. Participants included representatives from various state game agencies, government, various universities and energy company environmental scientists. One other BLM biologist was able to attend the workshop for one of the three days. Fourteen papers were presented and an all day field trip tour of sage grouse habitat was conducted. Two other papers were scheduled to be presented but the authors were enable to attend the workshop. The objectives of the workshop are given in the By-laws of the Western States Sage Grouse Committee (Enclosure 1). These objectives were met within the limits of time allowed for the workshop.

Papers presented:

1. Analysis of Past Survey Data for Setting Future Seasons. Charles Eustace, Montana Dept. Fish, Wildlife and Parks. (No abstract available)

   Mr. Eustace's objectives were to see if any survey data (wing counts, hunter check stations, breeding ground survey, brood counts etc.) could be correlated to reflect hunter harvest of sage grouse. Although the data is inconclusive at this time some interesting correlations were shown that might have value in helping to determine future hunting seasons. His data indicates that productivity

(Guidlines on reverse of first page)

STATE DIRECTOR

follows a 10 year cycle, hunter harvest appears to reflect this cycle, there is a negative correlation between numbers of males on breeding ground and hunter success, brood count data is difficult to correlate and the percent of hens successful appears to reflect climatological conditions in the spring. He noted that the number of sage grouse hunters has remained relatively constant and that weather conditions in most cases does not affect opening day harvest. Further data inquisition and analysis may lead to a better approach to setting seasons for sage grouse than the "SALY" (same as last year) method currently used.

2. Sage Grouse Population Trends and Dynamics in Colorado. Clait E. Braun, Colorado Division of Wildlife. (Abstract included)

Mr. Braun presented an interesting paper with much statistical and graphic support. His abstract has been included and detailed information can be obtained from him. As a result of his studies Mr. Braun considers information gained from wing surveys provides the most valuable information on sage grouse population structure and trends. He stated that the information gained from wing counts is equivalent to information from banding studies in terms of population structure. Although he recommends that lek or breeding ground counts be discontinued as indicators of short term population trends he emphasized the importance of locating all breeding grounds and monitoring for activity. He stressed that habitat conditions around breeding grounds are of vital importance to sage grouse and can affect the use of a breeding ground. He also made note of the fact that like Montana, the number of sage grouse hunters remains relatively stable. Mr. Braun noted that hunting does not significantly affect sage grouse populations or trends (10% or less of fall population removed). Changes in habitat, climatological conditions and other factors such as population cycles directly influence sage grouse populations.

3. Application of Remote Sensing for Sage Grouse Management in South Dakota. Robert G. Best, South Dakota State University. (Abstract included)

Mr. Best indicated the value of using remote sensing in evaluating sage grouse habitat. He evaluated several types of imagery and techniques during his study. During his study he developed techniques and equipment that can be used for low cost remote sensing. I have requested this information from him and will make it available as I receive it.

4. Relationship of Spring Moisture to Fall Populations. Bob Watts, Montana Fish, Wildlife and Parks. (No abstract available)

Mr. Watts presented information indicating there is an apparent relationship of rainfall and sage grouse production. His data indicated that rainfall of one inch or more during the period of egg-laying inhibited nesting success of sage grouse. Rainfall in excess of one inch during the same time periods before and after egg laying did not appear to affect nest success.

5. Sage Grouse Habitat Selection in North Park, Colorado. Tom Schoenberg, Colorado State University. (Abstract included)

Mr. Schoenberg presented an interesting array of charts, graphs and statistics in support of his presentation. His data indicates there is selection by sage grouse for habitats. He was able to show that this selection is not readily apparent with low powered or normally used statistical methods. He noted that one habitat parameter commonly measured, density, does not reflect habitat selection. He found that canopy coverage and plant dimensions were the parameters that gave the best information about habitat selection by sage grouse. Mr. Schoenberg's techniques and findings will probably be a great value in management of sage grouse habitat.

6. Summer Use by Sage Grouse of Irrigated Agriculture in Southeast Idaho. Robert J. Gates, Montana State University. (Abstract included)

Mr. Gates presented information on use of agricultural land by sage grouse. His ongoing study indicates that alfalfa is attractive to sage grouse for summer use and noted that harvesting of occupied agricultural lands caused displacement of sage grouse into other cover. He noted there was little use of fields after harvest.

7. Winter Flocking Behavior and Habitat Use by Sage Grouse in Southeastern Idaho. John W. Connelly, U.S. Fish and Wildlife Service, Idaho. (Abstract included)

Mr. Connelly presented an excellent paper, the main points are well presented in his abstract. Points that were noted in the discussion that followed were that a mosaic of stands of sagebrush or patchiness in structure is necessary for good management. This allows for movement of grouse to suitable cover during different weather conditions. In quantifying habitat characteristics the circular plot method was used to enable comparison of his study with others. It was hypothesized that large flocks of wintering sage grouse may be a predator avoidance mechanism. He noted that sage grouse did

not utilize areas of apparently suitable habitat and therefore surveys were essential in determining wintering areas. He also noted during the discussion that sage grouse in the study maintained a summer range up to 60 km away in some instances.

8. Techniques for Trapping Sage Grouse in Colorado. Ken Gieser, Colorado Division of Wildlife. (Abstract included)

Mr. Giesen's abstract summarizes his presentation. During a short discussion he noted that a tape recording of snowmobile engine noise was played by persons netting grouse to mark the sound of approach and helped prevent flushing.

9. Effects of Sagebrush Eradication and Range Re-seeding on Sage Grouse in Southcentral Utah. George Enyeart, North Dakota Game and Fish Department. (Abstract included)

Mr. Enyeart gave a short presentation on the results of a four-year study initiated in 1951. He observed that breeding grounds located on reseeded areas were smaller than grounds located on non-reseeded areas. He also noted that in the study area hens and broods were concentrated along streams, possibly due to the abundance of forbs. There was an avoidance by sage grouse of areas heavily utilized by cattle and sheep. He recommended that breeding grounds and adjacent sagebrush cover be left undisturbed during range improvement work that involves eradication and reseeding. As a closing comment he stated that range improvement to date has often been for improved grazing many time at the expense of wildlife.

10. Winter Nutrition of Sage Grouse in North Park, Colorado. Tom Remington, Colorado State University. (Abstract included)

Mr. Remington s presentation is outlined in his abstract. He emphasized that sage grouse selected sagebrush that was around 17 cm in height (exposed above surface of snow or ground) for feeding. His preliminary findings on nutritional quality of sage grouse foods indicate that the diet of the sage grouse is of high quality in terms of protein and certain tract elements. He found during his study that sage grouse tended to feed in a line, making it relatively easy to observe feeding grouse then run a line transect along the feeding area to determine its characteristics.

11. Use of Interest Money to Preserve Sage Grouse Strutting Grounds. Dan Schmidt, North Dakota Game and Fish Department. (Abstract included)

Mr. Schmidt gave the background and progress report on the use of interest funds to preserve sage grouse strutting grounds in North

Dakota. He noted that grounds in North Dakota that have been disrupted tend to become extinct with no evidence of alternate sites being established. This is of major concern to the North Dakota Game and Fish Department. He indicated that future work will consider preservation of escape cover and nesting habitat around strutting grounds.

12. Dispersal of Sage Grouse from the Test Reactor Area of the Idaho National Engineering Laboratory. Howard Browers, Jr., South Dakota State University. (Abstract included)

Mr. Browers used radio telemetry and patagial markers to monitor movements and migration of sage grouse. He found that average summer home range averaged 46.8 ha and a mean of 3111 ha was calculated for the winter range. Movements to winter areas ranged form 4.2 to 34.5 km which a mean of 11 km.

13. Preliminary Observations on Use of Solar-powered Radio Transmitters on Juvenile Sage Grouse. Peter Dunn, Colorado State University. (Abstract included)

Mr. Dunn found that solor-powered radio transmitters worked well with few problems of failure. At the end of his study he hopes to gain information on the establishment of new leks by young males. The findings of his completed study should be quite interesting.

14. Reclamation of Sage Grouse Habitat - Suggestions for Surface Coal Mines. Bonnie Postovit, ARCO Coal Creek Mine, Wyoming. (Abstract included)

Ms. Postovit presented interesting insight into wildlife habitat reclamation on surface coal mines. She emphasized the necessity of assessing the mine site before disturbance. This included soil analysis, vegetative community quantification and use areas by wildlife. On her study site it was determined that riparian type habitat and patchiness in the sage grass habitat were essential for sage grouse and other wildlife. Based on her pre-mining assessment she was able to recommend reclamation procedures that would benefit wildlife. Portions of her work included trying to move sage grouse breeding rounds off the mining area into adjacent habitat. To date she has had little success using decoys and taped calls. Ms. Postovit pointed out that reclamation work depended heavily on the projected post mining use of the area. She noted that grazing of an area would probably have negative effects on wildlife habitat reclamation unless it was carefully monitored and controlled.

FIELD TRIP

The field trip tour was conducted on September 2, 1981, we left at 8:00 am and returned to Bowman at 7:00 pm. Several strutting grounds were visited as well as a couple of prairie dog towns near these grounds and a visit was made to a big game exclosure located on BLM land. We visited two strutting grounds that have been plowed and made an examination of the area. It was determined that reclamation of the strutting grounds by North Dakota Game and Fish was showing promise but a key component in strutting grounds, escape cover around the ground and breeding habitat should be given equal if not greater consideration. In areas where sage grouse have shown declines or poor success examination of the sagebrush cover showed decadence and reduction of canopy coverage. Some observers commented that the habitat was of high quality for sharp-tailed grouse and low to medium quality for sage grouse. It was also noted that in many areas in the sage grouse range there is little overlap of habitat usage such as is found in North Dakota. We toured sage grouse breeding grounds and nesting areas in an oil and gas field. It was generally agreed that oil and gas activities have little or no effect on sage grouse providing breeding grounds are not destroyed or large areas of cover are removed. Observers from Colorado mentioned that there was extensive oil and gas activities on some of their research sites with no adverse effect on sage grouse. At one site an oil and gas access road passed through the middle of a breeding ground. The only noticeable effect was the grouse moved their activities a few meters off the road according to North Dakota Game & Fish personnel. During the visit to the big game exclosures on BLM land numerous questions were aked about BLM's grazing program in the area and habitat management practices in effect. I was able to give a brief overview of the BLM grazing program and the system in effect. There was concern expressed that although the present stocking rate did not appear to be damaging to the range it was too heavy to allow sufficient cover and food for sage grouse, antelope and other game in the area. A need was identified to implement habitat management and enhancement techniques for the sage grouse and antelope populations in the area.

BUSINESS MEETING

The business meeting was held at the end of the workshop on September 3, 1981. The management guidelines Sage Grouse Management Practices was discussed (Enclosure 2). It was recommended that these management practices be used as a guideline by all agencies and individuals concerned with sage grouse management. A distribution map is being developed that will provide definitive information on sage grouse distribution. Upon completion it should be a valuable tool for land managers.

COMMENTS

The Twelfth Western States Sage Grouse Workshop was successful in meeting its objectives and was very informative. Many comments were made to me about BLM participation that was favorable. One participant commented that in 15 years of attending workshops and meetings this is the first where a BLM representative was present and actively participated. He and others indicated that more participation by BLM would be desireable as BLM manages large expanses of wildlife habitat and our input into these workshops and meetings would be extremely valuable. I agree with this and recommend that appropriate representative from BLM attend and participate in forth coming sage grouse and other workshops and meetings whenever possible.

Craig Altop

Craig Altop
Wildlife Biologist

Encl 1

ORGANIZATION AND FUNCTIONS OF THE WESTERN STATES SAGE GROUSE COMMITTEE OF THE WESTERN ASSOCIATION OF STATE GAME AND FISH COMMISSIONERS

BY-LAWS

I. DESIGNATION

The organization will be known as the Western States Sage Grouse Committee.

The official information publications of the committee will be known as the Western States Sage Grouse Questionnaire and the Western States Sage Grouse Workshop Transactions.

The meeting of the committee will be known as the Western States Sage Grouse Workshop.

II. OBJECTIVES

The objectives of the Western States Sage Grouse Committee and the Workshop are:

1. To provide closer liaison among persons engaged in sage grouse research and management.
   a. To discuss methods and techniques used in research and management.
   b. To discuss current projects, exchange new information and develop new ideas.
   c. To provide an opportunity for persons to participate in field activities that they might not be thoroughly acquainted with.
   d. To develop long and short range research and/or management needs for sage grouse.
2. To disseminate research and management information to the general public to inhance sage grouse management.

III. ORGANIZATION

1. The voting members of the Western States Sage Grouse Committee shall consist of one representative from each of the following state or provincial wildlife management agencies:

   Alberta Department of Lands and Forests
   California Department of Fish and Game

Colorado Division of Wildlife
Idaho Fish and Game Department
Montana Department of Fish and Game
Nevada Department of Wildlife
New Mexico Department of Game and Fish
North Dakota Game and Fish Department
Oregon State Game Commission
Saskatchewan Department of Natural Resources
South Dakota Department of Game, Fish and Parks
Utah State Division of Wildlife Resources
Washington Department of Game
Wyoming Game and Fish Department

At the invitation of the committee chairman, the U. S. Forest Service, Bureau of Land Management, and Soil Conservation Service may appoint one voting representative each to serve on the committee to discuss management of sage grouse habitat.

At the discretion of the chairman, universities, conservation organizations, or other groups or individuals may be requested to participate on an advisory basis.

Votes of at least six (6) participating states are required to transact committee business and a proxy vote will be allowed on questions of committee policy which have been circulated at least 30 days prior to the workshop.

2. The Western States Sage Grouse Workshop will be scheduled biennially. The host State or Province will select the time, and place for each meeting. The chairman will be the representative of the host State or Province and will serve for two years, or from the close of prior workshop to the close of the workshop that he is chairman of.

   The workshop will be as informal as possible to maintain the objectives of the committee.

3. The Western States Sage Grouse Questionnaire will be sent out annually to each State and Province representative by the committee chairman.

4. The new host state will be announced at the business meeting of the Sage Grouse Workshop.

5. The responsibilities of the chairman will be to organize and corduct business at the workshop, maintain the objectives of the committee, prepare and distribute the Sage Grouse Questionnaire and Sage Grouse Workshop Transactions, and appoint subcommittees as necessary to carry out the Western States Sage Grouse Committee responsibilities.

Adopted September 6, 1979
Biennial Meeting
Twin Fall, Idaho

Encl 2

WESTERN STATES SAGE GROUSE COMMITTEE

SAGE GROUSE MANAGEMENT PRACTICES

JULY 1981

SAGE GROUSE
MANAGEMENT PRACTICES

WESTERN STATES SAGE GROUSE COMMITTEE

ROBERT AUTENRIETH

WILLIAM MOLINI

CLAIT BRAUN

JULY 1981

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INTRODUCTION

Sage grouse (*Centrocercus urophasianus*) management in western North America was assisted by the creation of the Western States Sage Grouse Committee in 1954. This Committee was organized to provide better dissemination of research and management information among workers involved with sage grouse. The following objectives were formulated as a basis for the functions of the Committee and the Workshop:

1. To provide closer liaison among persons engaged in sage grouse research and management.
   a. To discuss methods and techniques used in research and management.
   b. To discuss current projects, exchange new information and develop new ideas.
   c. To provide an opportunity for persons to participate in field activities with which they might not be thoroughly acquainted.
   d. To develop long and short range research and/or management goals for sage grouse.
2. To disseminate research and management information to the general public as an aid to sage grouse management.

The Committee has been partially successful in meeting these objectives. Sage grouse management philosophies have been developed, refined and disseminated.

Sage grouse management practices and techniques have been discussed in depth at several Workshops. While most states follow a similar pattern of data collection and analysis there remain areas of variability concerning management emphasis. An example is the population trend and status map which is a part of the annual questionnaire. Population trends as depicted often show dramatic changes at state or province boundaries. This situation may be influenced by the lack of a coordinated approach to sage grouse management.

These Guidelines are intended to define the most useful sage grouse

management practices that have been developed.

It is recognized that cooperating state and provincial wildlife agencies have various management options available that will be implemented as dictated by the particular situation (size and recreational value of the sage grouse resource, priority status of the sage grouse resource in terms of overall wildlife program objectives, manpower, monetary and political constraints, etc.). In this respect these Guidelines are not intended as a mandate for sage grouse management. It is the expressed hope of the Committee, however, that these Guidelines will serve as a catalyst for a coordinated approach to sage grouse management which will result in the greatest benefit to the sage grouse resource throughout its range in western North America.

MANAGEMENT PHILOSOPHY

States and provinces with viable populations of sage grouse generally have a management philosophy based on the annual monitoring of population trends and use of these data to support harvest programs. There is variation in the techniques used to monitor population trend, but a combination of all or some of the following procedures are universally applied:

1. Lek counts
2. Brood counts
3. Harvest data analysis
4. Age and sex analysis from wings
5. Climatological considerations

Most states adjust season length and bag limit to reflect the long term population trend. Adjustments are seldom made for short term fluctuations unless mandated by bio-political considerations.

The fact that overharvest of sage grouse has not been documented by the states and provinces has failed to dispell the fears of managers and sportsmen. The annual data collection effort is probably most important in satisfying

citizen concern for the resource during season setting hearings. Also, production data provides the basis for informing the hunting populace of apparent sage grouse abundance. Hunter participation is often influenced by the tone of news releases prior to the season opening.

The Western States Sage Grouse Committee believes the management philosophy should be to maintain sage grouse populations at the highest possible level consistent with the constraints of other biotic factors in the ecosystem; and provide optimum recreational use. Other objectives or philosophies are:

1. To inventory and accurately delineate distribution and important (key) habitat areas.
2. To monitor sage grouse population trends on an annual basis to provide data on population changes.
3. Population monitoring should include an annual review of the factors which influence population levels. A combination of data sources should be used for annual population trend monitoring.
4. Biologically sound management programs should be sustained with recreational hunting being allowed on all viable populations.
5. Sage grouse habitat monitoring should be an integral part of the management scheme to:
   a. Preclude further reductions in habitat quantity and/or quality.
   b. Enhance habitat quality and/or quantity wherever the potential exists and whenever the opportunity arises.

MANAGEMENT PROCEDURES

Inventory

Before any management system can be devised or applied an inventory of resource parameters is essential. The application of effective sage grouse management is predicated on knowledge of resource parameters including:

1. Size and location of the occupied habitat or the total distribution

of the species.

2. Identification of habitats essential in the annual life cycle.

3. Density or relative abundance.

These parameters should be delineated on appropriate maps to serve as a reference for management and planning. The committee recommends that all member states and provinces plot important distributional data on U.S. Geological Survey (AMS) maps (scale 1:250,000). This map is recommended because it provides sufficient detail of western North America.

Information to be delineated:

1. Occupied sage grouse range
2. Leks
3. Brood rearing areas
4. Winter use areas
5. Areas of habitat modification (sagebrush control, controlled burns, wildfires and energy development and reclamation)
6. Important hunter use areas.

This information should be of benefit in designing basic management programs, habitat management planning, and monitoring land use activities.

Lek Surveys and Counts

Counts of males on leks are currently used by all states as an index to relative population levels. Most states consider the counts to be useful in identifying short and long-term trends. Two distinct approaches are taken which we will define as (1) lek surveys, and (2) lek counts.

Surveys document the presence or absence of male sage grouse on a number of established leks. They are usually conducted from an aircraft and allow the investigator to cover a large area. This technique is commonly used to locate new leks.

Counts entail actual censuses of the number of male sage grouse observed

on a particular lek. Thirty percent of all leks should be counted as a minimum to adequately reflect the population trend (Braun pers. commun.). Utah found that the average number of cocks per lek is sigrificantly correlated (r = 0.83, N = 9) with subsequent fall hunter success. Their analysis indicates that those regions where few leks have been surveyed (and presumably a smaller percentage located) have less correlation between cocks per lek and hunter success.

Based on studies of mountain valley (2,400 m (7,874 ft)) leks where predictability of lek location and attendance may be less than lowland (1,350 m (4,429 ft)) leks, Beck and Braun (1980) concluded that lek counts had no proven value as a population index or estimator.

The Committee feels that lek locations identify key habitat areas and annual counts may provide data on long term population trends since this population segment should be the most sensitive to a declining population trend. Caution is advised in the interpretation of counts as a high level of variance has been observed in the daily attendance of males at individual mountain valley leks (Braun and Beck 1976, Beck and Braun 1980). Due to inter-lek visitations, especially by yearlings, it is advised that same day counts be conducted on all leks in a particular complex (G. Rogers, pers. commun., Schlatterer 1960, Emmons 1980). Counts are most useful when combined with other measures of population status, e.g. brood surveys, hunter harvest data and wing data.

Lek counts provide information on:

1. The relative importance of a particular area for sage grouse.
2. Annual population trends, especially when considered in combination with other population parameters such as percent yearlings and juveniles in the fall harvest.
3. Long term trends which provide insight into habitat condition and overall health of the bird populations.
4. The spring distribution of birds.

5. Nesting habitats, since most nesting occurs in the vicinity of leks (Wallestad and Pyrah 1974, Petersen 1980).

6. Areas for trapping-banding operations.

Furthermore, there is value in requiring counts to insure management personnel work with the species in the field--which may help in interpretation of habitat and population status.

In summary, lek observations may be a useful indicator of long term population trends. However, the high variance in these data indicates that other forms of information be collected as well. It would be risky to base management recommendations solely on lek counts. More research is needed to ascertain the reliability and confidence levels for population estimates based on this technique.

Lek Terminology

Lek: *(strutting ground) usually located in an open area of low sage, along a ridge, bench, road or airport, near a salt site or reservoir or in a meadow where sage grouse traditionally display and breed.*

Primary Lek: *a stable lek which has a record of annual activity for the past 5 years. Such leks are active regardless of the annual population density, and can be considered a nucleus for the population in question.*

Satellite Lek: *a lek which is near a primary lek, but which fluctuates more drastically on an annual basis in response to population density. Such leks may become totally inactive in low population density years.*

Lek Complex: *an association of leks that are generally in close proximity and which serve the same population. Birds may interact between these leks.*

Active Lek: *a lek which was active during the past breeding season, or at the last time checked.*

Inactive Lek: *a lek that was inactive during the last breeding season, or the last time checked.*

Count Technique

Time of year -- The appropriate time of year for lek observations will vary according to elevation, climatic conditions between areas and from year to year. Counts should be conducted during the 3 weeks after the peak of mating activity which usually occurs from mid-March to early April (Jenni and Hartzler 1978, Emmons 1980). This time is best as the maximum number of males is present on leks. Care must be taken not to mistakenly include hens in the male count.

Time of day -- Counts should be conducted as close to sunrise as possible and may be conducted from first light to a half hour after sunrise (Patterson 1952). Surveys may be conducted later in the day to document use by sage grouse of particular leks. It must be realized that absence of males will not necessarily demonstrate a lack of use. Predator harassment may cause a low count or complete absence of cocks on a lek. Leks not showing use should be rechecked.

The phase of the moon may affect use patterns of leks. During a full moon, grouse may display at night and consequently terminate activities earlier in the morning. In contrast, birds may use leks well into the morning during the dark or new phases of the moon.

Frequency -- After established leks have been located from at least 2 years of previous observations, surveys may be conducted once each spring. During the initial phases of establishing survey areas, 3 surveys should be conducted over the use area at weekly intervals beginning in mid-March to early April for low elevations and mid-April for high elevations. Counts require more field time. A minimum of 3 counts should be conducted following the peak of the mating season (at least 1 count each week over a 3 week period).

Because of the importance of leks as key areas, and the beneficial ramifications for habitat protection, a continual effort to locate new leks should be an integral part of the sage grouse management program.

Sample Size -- Limitations on time and manpower usually establish the maximum number of leks which can be visited. If less than 100% of the total leks will be counted, a sampling system must be established to sample leks over the total area. Once a sampling system is devised, the same leks should be censused each year.

Weather Conditions -- Optimum weather conditions for surveys and counts are clear and calm. Wind speeds should be less than 32 kph (20 mph). Temperature seems to have little effect on lek activity. Detailed weather conditions should be recorded each time lek observations are made.

Brood Counts

Management Applications of Collected Data

Brood counts are traditionally used in sage grouse management to estimate chick production, relative abundance, and population structure. These data have often been used for determining harvest management direction such as season length and bag limits. A common problem is the difficulty in sampling all segments of the population. When circumstances allow collecting a representative sample of the population, the data when combined with other population data can be valuable in predicting fall population trends. Brood counts are also valuable in locating critical brood rearing habitats. As with lek counts, these surveys put the biologist in contact with the resource and may provide valuable insight into habitat conditions and trends.

Methods of Counts

Timing -- Brood counts should be conducted during the first and during the last 3 hours of daylight. They should be conducted during the 11th, 12th, and 13th weeks after the peak of hatch (established by observing the peak of breeding), or when environmental conditions concentrate birds. This period usually occurs from mid- to late-July, but may vary from year to year and by elevation.

Types of routes -- Routes should be of sufficient size to adequately sample the sage grouse habitat and populations -- locally and statewide. Two basic sampling approaches are used: (1) established brood count routes and (2) random brood counts.

Established brood routes are counted annually through the same area. If a vehicle is used, speeds should not be greater than 32 kph (20 mph) along the route. To avoid driving into the sun, morning routes should be driven from east to west with evening routes being driven from west to east. Results of such surveys are enhanced by the inclusion of established walking routes.

Many observers have noted that established routes may not yield comparable counts in some years due to distribution changes associated with variation in food and water availability. When such routes are used, environmental variability must be considered in data interpretation. To reduce the problem, area or random brood counts are conducted by many states. The observer works those areas which possess the greatest concentration of birds. Although this approach will increase sample sizes, the relative abundance of birds is clearly biased by selection of concentration areas.

Data to Record -- Information usually collected on brood counts is the number of chicks per hen. Although average brood size information may be of some value in assessing reproductive success, this data does not generally reflect overall production. In situations where all segments of the population can be sampled, particularly successful and unsuccessful hens, the rate of production as expressed in terms of chicks per hen (using both successful and unsuccessful hens) can be valuable in determining reproductive success and predicting fall population levels.

It is important to record the number of chicks observed in each brood and the number of hens with broods. It is often difficult to make an accurate count as some chicks may hide in vegetation. To aid in counting, a dog may be used to assist in flushing the birds. A chick distress call may also be

used to aid in locating the hen. The number of hens observed without chicks should be recorded separately. If feasible, complete information on the sex and estimated age of each bird observed should be recorded. These data may be used in compiling estimates of relative abundance in the form of the number of birds observed per kilometer or hour of brood survey.

Climatological Information

During the hatching period, wet and cold weather can significantly reduce chick survival. However, wet weather prior to the hatch and subsequent to the chick vulnerability period provides increased forb production and probable increased survival of chicks. Close monitoring of nesting and hatching periods is desirable when spring precipitation and temperature are used to aid in making fall population estimates. Lek, brood age, and prior years' wing data will all be useful in determining the peak of hatch.

Another climatic factor that may influence the apparent abundance of birds is summer and early fall precipitation. Wet conditions may cause widespread dispersal of sage grouse populations. This lack of concentrations may lower the number of birds observed during brood counts and hunter success during the hunting season. Although dispersal may enhance sage grouse survivorship, the biologist or hunter may mistakenly report lower sage grouse abundance.

Best data are obtained when several weather stations are located throughout the area under study. Where these are not available, the U.S. National Climatic Center provides monthly climatological data reports for most areas.

Extremely dry, cold winters can result in winterkill of sagebrush which may significantly reduce sage grouse habitat. Heavy snow may affect sage grouse survival (by increasing the predation rate) in extreme years, but where adequate winter habitat is available, the effects of snow are seldom serious. Droughts result in a diminution of usable sage grouse habitat by killing sagebrush, reducing forb availability and drying water sources.

Further research is needed on the relationship of weather and sage grouse

abundance. One goal should be the development of a predictive model for hatching and brood success.

Harvest Data Collection and Analysis

Proper collection and analysis of harvest data provides the information necessary for development of species management and research plans and programs. It also provides documented information for enhancement of the resource and mitigation of potential land use conflicts.

Desired Harvest Data

1. Sex and Age Composition of the Harvest
2. Distribution of Harvest and Hunting Pressure
   a. By Time Periods Within the Season
   b. Statewide and by Management Unit
3. Estimate of Hunter Success
4. Estimate of Total Harvest by Management Unit
5. Estimate of Total Hunter Participation

Methods of Obtaining Harvest Data

1. Sex and age composition of the harvest can most easily be obtained through examination of wings from hunter-harvested grouse. Wings can be obtained through use of check stations, wing barrels and/or prepaid postage wing envelopes. Field checks of hunters are less desirable than check stations because of the limited samples obtained and most hunters checked in the field have not completed their hunt.
   a. Check Stations -- Manned check stations are commonly used for a variety of species. The greatest advantage is the ability to individually question hunters about their activities. Disadvantages relate to cost and extensive use of manpower to operate the stations. Also total season data are not collected unless stations remain open the entire period.

b. Wing Barrels -- Volunteer wing collection barrels have recently come into use and have proven to be a useful tool when hunters are dispersed over large areas. Disadvantages relate to the obvious fact that only wings are obtained. Major advantages are that after the initial cost of construction, they are inexpensive to operate, have low upkeep and reduce manpower needs. One man can periodically check and collect wings from up to 50 barrels dispersed over a large area in one day.

c. Mail Wing Surveys -- Wing envelopes have been used by a number of states and the U.S. Fish and Wildlife Service to obtain wings from game birds. Normally they are distributed to a sample of hunters at license agencies, post offices, sporting good outlets or selected from a list of license purchasers. Advantages relate to cost (inexpensive in terms of data obtainable), and the ability to acquire other harvest data by including a series of questions on the envelope. Disadvantages are those of sampling intensity, distribution of desired samples, and reluctance of hunters to use them.

2. Distribution of harvest and hunting pressure is most frequently obtained through use of mail questionnaire surveys. However, some data can be obtained through use of manned check stations, and aerial flights over hunting areas to map distribution of vehicles.

a. Questionnaire Survey -- Mail questionnaires are widely used but unless 25-30% of the hunter population is sampled, problems exist in extrapolation on a management unit basis. Most state-wide surveys sample only 1 to 10% of the hunter universe and may overestimate hunter numbers and harvest. Overestimates of 100% or more may occur. Other problems relate to length of time after the close of the season before questionnaires are sent.

multipurpose questionnaires that ask about all species of game hunted, nonresponse, species misidentification, memory bias and prestige bias. Questionnaire surveys should be designed by biostatisticians and wildlife managers working together. The most reliable data can be obtained by single species questionnaires which are sent as close to the end of the season as possible.

b. Manned Check Stations -- Use of check stations is a reliable tool to measure distribution of harvest, hunter success and hunting pressure. If used, they should be multipurpose with all possible desired data being obtained. They are generally not useful in ascertaining statewide or regional harvest and hunter levels unless unique hunter access situations exist or a large enough number of stations are operated to adequately sample a given region. They are exceedingly useful on a management unit basis where only a few access points exist into the hunting area.

c. Aerial Flights -- Counts of vehicles in hunting areas have been used for many years to give a quick estimate of hunter pressure and distribution. They have little value for estimating harvest unless number of hunters per vehicle and average harvest per hunter are known.

3. Measures of hunter success are normally obtained from questionnaire surveys and check stations. Both provide reliable data with the estimates derived from check stations being the most reliable. This high degree of reliability is a function of the immediacy of the data being collected.

4. Total harvest and hunter participation, while frequently desired, is of significant management value only when substantial biological data for a population are available. This information may be of value in the overall assessment of land use values. More useful data are birds per active hunter and the sex and age composition of the harvest. However, most administrators, many field personnel and frequently the various publics demand estimates of total harvest and participation. It should be noted, however, that total harvest frequently has little relationship to any real biological phenomena, but it may be used to influence land use decisions, particularly in concert with total hunter days of recreation. Estimates of total harvest and hunter participation are most commonly obtained from questionnaire surveys. Problems associated with these surveys have been previously discussed.

Harvest Data Analysis

Sex and Age Composition -- of utmost importance are the questions of sample adequacy and geographical representation. If sage grouse occur in definable (geographical) populations, wings collected should be kept separate and analyzed by population. Once analyzed, decisions can be made whether or not to pool data from a series of populations. Ideally, attempts should be made to obtain a representative sample of at least 25% of the actual harvest. If this is not possible or feasible then efforts should be made to obtain at least 100 wings from adult and yearling hens that are harvested from each population. This should provide a reliable estimate of turnover in the female segment of the population if done over time (at least 3 years) as well as an estimate of production based on the number of chicks per hen (providing that harvest is representative). It is also likely that adequate samples of wings from young of the year and adult and yearling cocks will be obtained at the same time.

Wing sample sizes required for specific populations can be estimated if the approximate population size and the expected proportion of young in the sample can be determined (this can be estimated based on previous results). One source of this information is titled Tables for Determining Sample Size and Sample Error by Portman et al. (1975).

An example of how this can be used follows:

Given an estimated population size of 5,000 for an area and 60% young in the population the following sample sizes are required for various levels of precision. A random sample is assumed.

Precision	Confidence Level (%)			
(Sample Error)	90	95	99	99.7
.01	2,825	3,242	3,805	4,044
.02	1,226	1,578	2,216	2,569
.03	631	850	1,307	1,598
.04	375	517	830	1,045
.05	247	343	565	723
.06	174	244	406	526
.07	129	181	305	397
.08	99	140	237	310
.09	79	111	189	248
.10	64	91	154	203

Collected wings should be separated by male and female for young of the year, yearlings and adults. This is easily done using established techniques (Eng 1955). Primary molt should be recorded for both sexes and all age classes. The sequence of primary molt and length of the recently replaced adult primary

of young of the year are used to estimate hatching dates. The number of old primaries retained by yearling and adult females is compared to the number of old primaries retained by adult and yearling males to estimate nesting success. Yearlings should be compared to yearlings and adults should be compared to adults. The technique is based on the fact that cocks begin molting shortly after termination of lek activities. Nesting hens delay their molt until nesting is terminated. Hens molting in a pattern similar to cocks either did not nest, or were unsuccessful nesters. Brood hens exhibit a molt pattern similar to chicks (Figure 1).

Production success should be recorded as young per female (combining adults and yearlings) and as young per successful female.

Hatching distribution should present the range and peak periods and can be related to weather conditions during calculated hatching periods and appearance of females on leks.

Once data on sex and age composition of the harvest are available for 3 or more years, estimates of annual turnover and survival by age and sex class can be derived. Assumptions that have to be considered are whether the population in question is annually stable, increasing or decreasing.

Distribution of Harvest and Hunter Pressure -- These data should be presented as totals and percentages of totals by geographic areas, management units, regions, and statewide. They can be further recorded by elevation and climatic zones, or any land unit or zone which has management applicability.

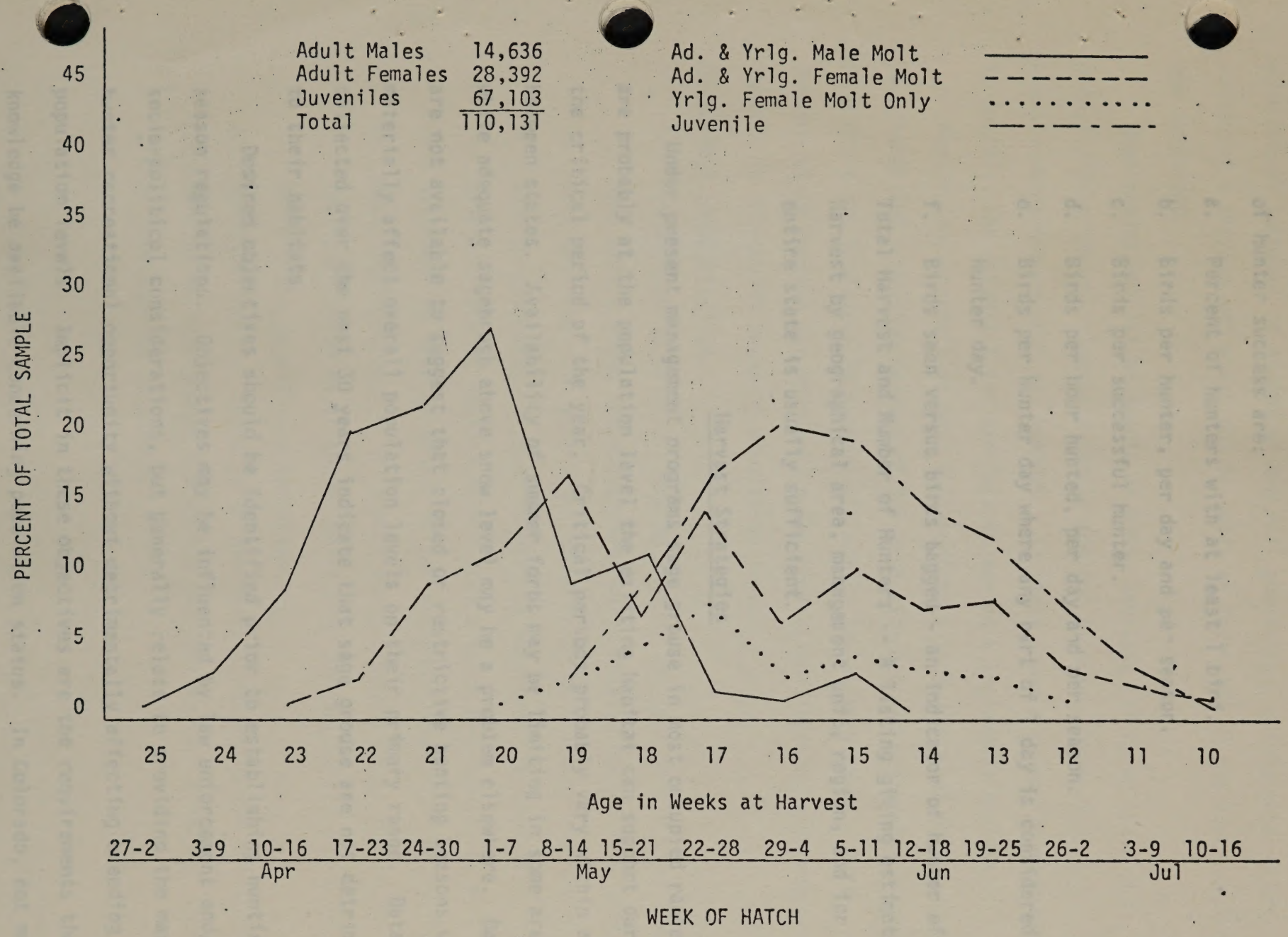
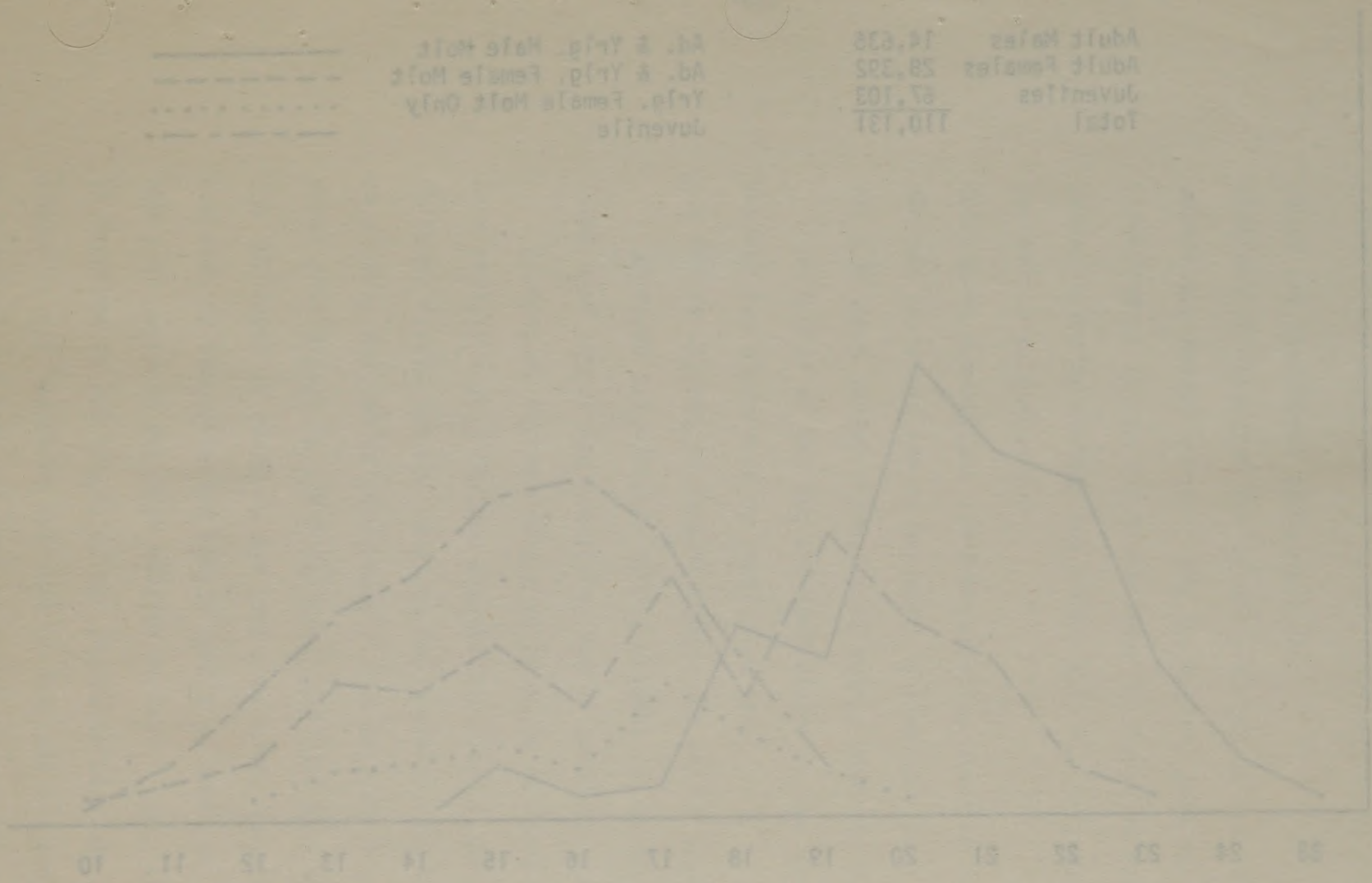


Figure 1. Distribution of sage grouse hatch and molt, Idaho 1961-1980.



Hunter Success -- Types of useful data obtained from estimates of hunter success are:

a. Percent of hunters with at least 1 bird.

b. Birds per hunter, per day and per season.

c. Birds per successful hunter.

d. Birds per hour hunted, per day and per season.

e. Birds per hunter day where any part of 1 day is considered 1 hunter day.

f. Birds seen versus birds bagged - an indicator of hunter efficiency.

Total Harvest and Number of Hunters -- A listing giving estimated harvest by geographical area, management unit, region, and for the entire state is usually sufficient.

Harvest Strategies

Under present management programs sage grouse in most occupied ranges are probably at the population level the existing habitat can support during the critical period of the year. Critical periods probably vary within and between states. Availability of summer forbs may be limiting in some areas while adequate sagebrush above snow level may be a problem elsewhere. Data are not available to suggest that closed or restrictive hunting seasons will materially affect overall population levels on their primary range. Data collected over the past 30 years indicate that sage grouse are not detrimental to their habitats.

Desired objectives should be identified prior to establishing hunting season regulations. Objectives may be influenced by law enforcement and/or socio-political considerations, but generally relate to providing the maximum hunter recreational opportunity without detrimentally affecting breeding population levels. Implicit in these objectives are the requirements that knowledge be available concerning population status. In Colorado, not more

than 10% of fall populations are being harvested (Braun pers. commun.). With annual turnover of 40-50% of the fall population, overharvest is not currently a problem and would not be until at least 30% of the birds available are harvested.

Sage grouse population levels in xeric habitats (15-25 cm (6-10 in) annual precipitation) fluctuate widely and due to range dessication are usually concentrated near wet meadows. If these areas are readily accessible to hunters, the potential for overharvest may be a legitimate concern.

Regulations controlling most fall hunting seasons for sage grouse could be liberalized. Hunting seasons of 30+ days with bag and possession limits of 3 and 6 are biologically supportable within the primary range. Such seasons would enhance the opportunity for recreational hunting with negligible impacts on subsequent breeding population levels.

Management Considerations

1. Season Opening Dates -- Hunting seasons for sage grouse should not open before young are independent which usually occurs 8-10 weeks post-hatching. In most areas young reach this age by mid-August. Time of dispersal of young is also an important consideration. In general, hunting seasons should open between mid-August and mid-September to take advantage of the maximum number of birds available.
2. Anticipated Harvest -- Allowable harvest approximates 30% of the fall population on an annual basis. At harvest levels above 30%, harvest may be additive mortality.
3. Shooting Hours -- There is no biological reationale for not allowing hunting of sage grouse during all daylight hours. Normally, hunting is from sunrise to sunset.

4. Bag and Possession Limits -- Daily bag and 2-day possession limits should be reasonable and attainable. Data are not available which clearly demonstrate the relationship between total harvest and restrictive or liberal bag and possession limits (C. Braun pers. commun.). Data do indicate that restrictive limits are of little management value, and such limits are not recommended except under unusual circumstances. Limits of 2 and 4 are commonly used, but 3 and 6 limits are more desirable and should be a management goal in primary sage grouse range. Hunter psychology should be considered in management strategies so that hunters have a reasonable chance of obtaining limits. Bag and possession limits may also be used to effect changes in hunter distribution.

5. Season Closing Dates -- Hunting seasons should close prior to onset of frequent winter storms. Sage grouse congregate in large flocks at this time and may be vulnerable to overharvest. Knowledge concerning winter stress for sage grouse is lacking.

Dissemination of Information -- Sage grouse hunting regulations and information on population trends and predicted bird availability should be disseminated to interested publics 3-4 weeks prior to the start of the season. Information efforts should be in a series of announcements through a variety of media. A well-planned ongoing program of public education concerning the general population biology of sage grouse should be undertaken, where such programs are needed to enhance sage grouse management.

Synthesis and Integration

While individual units of data collected for populations of sage grouse may be useful, only when all data available are properly synthesized and integrated can management plans be developed. The objective of most management data collection should be to prepare simple predictive models. Thus given

event X, managers should be able to predict what will happen to an individual population. The more and the better the quality or reliability of the data, the more precise becomes the prediction. Much of the information necessary for the conceptual development of simple predictive models has been collected However, data collection has not been uniform within a state or among states. Important components of a simple model in decreasing order of priority (increasing sequence for complex models) are:

1. Sex ratio of the breeding population.
2. Estimate of breeding population size.
3. Nesting success by age class of female.
4. Young survival per brood to a certain time.
5. Percentage of females that reproduce by age class.
6. Average clutch size by age class of female.
7. Egg fertility.
8. Composition of the annual harvest.
9. Estimate of annual harvest size.
10. Climatic variables during important events (nesting, hatching, early brooding, winter).
11. Habitat variables (alteration patterns, quality of food, availability, etc.).
12. Land ownership patterns and attitudes of landowners.

HABITAT MANAGEMENT

This section does not supersede the "Guidelines for Habitat Protection in Sage Grouse Range" as developed and adopted by the Committee in June 1974. Instead, it supplements those guidelines with new information and covers areas of concern which were not originally addressed. While we emphasize sage grouse, resource management can only be legitimately applied through an ecosystem approach. Our emphasis is not an attempt to dictate management priorities but

is given to provide insight into the effects of habitat manipulation on sage grouse. The guidelines are somewhat general due to the many differing habitats encountered throughout sage grouse range. The intent is to provide land and wildlife managers with data and alternatives to compliment onsite evaluation and aid the understanding of how livestock stocking rates affect sage grouse.

Sagebrush, long considered by many land managers to be an undesirable shrub, has been reduced throughout its range in western North America. Conservative estimates are that at least 10% of the 59-109 million ha of sagebrush lands have been altered through biological, chemical, or mechanical methods (Braun et al. 1976).

Daubenmire (1970) listed 6 concerns regarding sagebrush eradication:

1. There is little evidence to indicate the extent to which the desired grass increase (measured shortly after shrub eradication) is maintained . . .
2. The protection afforded many grass plants by dense clumps of shrubs is the sole reason why any perennial grass remains on much of the depleted ranges. Artemisia elimination opens the way to complete destruction of perennial grass by overuse.
3. Studies in Washington (Daubenmire 1969) have shown that for more than 4 months in the summer Artemisia tridentata uses only what water has percolated through the soil profile below the reach of grass roots ... The question should be raised: to what extent does the removal of this shrub allow some minerals to migrate permanently below the reach of grass roots ...
4. Removing Artemisia eliminates certain elements of the avifauna. While rearing their young these birds make a heavy drain on insect populations. Increased insects may damage the residual grass.
5. When Artemisia is removed by herbicidal sprays, certain perennial

broadleaved forbs are heavily damaged or eliminated (Hurd 1955, Blaisdell and Mueggler 1956, Mueggler and Blaisdell 1958, Anon. 1968). The loss is generally ignored on the tacit assumption that the unharmed grass, which supplies nearly all the domestic animals' food and which may produce more because competition is lessened, is the only component of economic significance. However, depending on the kind of vegetation and type of animals involved, spray removal of Artemisia may entirely destroy many desirable plant species and allow their replacement by inferior species and forage production may be seriously reduced for a period of several years (Blaisdell and Mueggler 1956). In western Colorado herbicides reduced forb production by 95%, yet these forbs contained more protein than the best of the forage grasses (Anon. 1968) ...

6. In some areas Artemisia promotes the uniform accumulation of snow and delays its melting; both are desirable from the standpoint of range management (Hutchinson 1965). Several of the consequences of Artemisia removal enumerated above involve an important ecologic principle. The more diversified the biota of an area, the more completely the environmental resources are being used, and the better the community is buffered against disease and weather hazards. Simplification of shrub-steppe vegetation by removing a major component that contributes a distinctive life form and phenology, and is necessary for other species to remain in the community, cannot fail to have serious consequences. If herbicides are used to remove Artemisia, other species are also eliminated. Rather than focus interest on just the quantity of grass available and acceptable to one class of domestic animal, those points should be studied broadly.

Researchers and wildlife managers have long emphasized the value of sagebrush for sage grouse. The future would be more encouraging if the above discussions were given greater consideration by land managers.

Sagebrush Control

Some of the current techniques employed for vegetative type conversion include spraying with 2,4-D and other herbicides. Chaining, plowing, burning and rangeland drills are also used.

Carpenter and Wallmo (1975) demonstrated in Colorado under certain conditions that sagebrush (Artemisia tridentata) spraying with 2,4-D can be conducted without total detriment to forbs. Application in early April (prior to forb emergence) achieved a 26% sagebrush kill and no forb mortality. Mid-April spraying killed 63% of the brush and 17% of the forbs. Later applications caused greater forb losses. It is important to note there was snow cover during both treatment periods. Carpenter states, "In other years forbs might be more or less advanced phenologically and slightly different results would occur if herbicide were applied on those dates." Important sage grouse foods, dandelion (Taraxacum officianale), western yarrow (Achillea millefolium lanulosa), pale agoseris (Agoseris glauca) and clover (Trifolium spp.) were killed when big sagebrush was sprayed with 2,4-D on 2 May 1980 in Idaho (R. Autenrieth unpubl. data). Managers should use phenological development as a guide for spring applications just as they now do for summer applications. Spraying should be conducted prior to forb emergence.

This technique will require further testing but potentially may allow for limited use to enhance brood rearing habitat. It may work well when applied to more productive north facing slopes in the 20-25 cm (8-12 in) precipitation zones.

The chemical Round-Up (Monsanta Chemical) can be applied to sagebrush during winter months and will kill only vegetation above the snow. It kills all plants contacted but applied during the forb dormancy period would have

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no effect on those nontarget species. In areas of mixed brush stands such as big sage-bitterbrush (Purshia tridentata), this chemical could not be used unless bitterbrush was also sacrificed. Further testing of the technique is needed.

Chaining is often used in juniper-sagebrush types. For it to be effective, plants must be mature and woody so they will be broken or pulled up. Chaining is preferable to spraying because existing forbs are not killed, all sagebrush is not removed, and the ground is scarified, enhancing the return of forbs. A strip chaining pattern using natural terrain features would be the technique of choice, as edge effect is maximized. Block chaining of large acreages is not desirable for sage grouse habitat, and should be discouraged. The technique of chaining followed by aerial seeding then chaining again to plant the seed was recently tested in Idaho (R. Autenrieth unpubl. data). The intent was to return a grass-forb component to the range without destroying the sage. It is too early to determine the success of the seeding but an estimated 50% of the brush survived. A nearby plow and seed treatment killed more than 95% of the brush.

Plowing is accomplished with the aid of a crawler tractor. The soil surface is turned and nearly all vegetation is killed. Reseeding is necessary. Plowing is the least desirable method. Plowing of random strips is less damaging to sage grouse habitat.

Prescribed fire is defined as the application of fire under conditions which will allow confinement of the fire to a predetermined area and accomplish the management objective (vegetation removal) with minimum damage to desirable vegetation. The technique has been used by the U.S. Forest Service on sagebrush lands in the 30 cm (12 in) or greater precipitation zones. Results have usually been positive in terms of forb response.

Controlled burns by the Bureau of Land Management in the 20-30 cm (8-12 in) precipitation zones have not been fully evaluated. Only recently has the BLM

begun to experiment with spring or late fall burns. They currently are testing spring burns on 3 districts in the West. Sage grouse workers should monitor these studies where possible. The test district in Idaho is in a heavily used sage grouse area that could benefit from increased brood rearing areas (R. Autenrieth pers. commun.). The expectation is a positive effect on this population. The best results seem to occur with April burns when fine fuels left from the prior growing season will carry a relatively cool fire. The ground must be damp, preferably with snow remaining. Small burns in irregular patterns or strips not exceeding 45 m (50 yd) in width and 90 m (100 yd) long are best. Where wild-fire is a concern, during summer months, burn strips perpendicular to the prevailing summer winds serve as fire breaks.

Spot-burns in which several patches of a few acres each are burned usually result in ideal use areas for sage grouse broods. Spot burns along the edges of meadows where sagebrush is encroaching may also enhance brood rearing areas, although care should be taken to leave an adequate sagebrush-meadow ecotone to provide necessary cover for sage grouse. However, without livestock control, the sites will probably receive concentrated use and sage grouse values may be lost.

Spring burns during the nesting period must be avoided, but late fall burns may be an alternative where brood rearing habitat is needed. Burning should seldom be allowed on areas where nesting habitat is limited or on winter use areas. It is well documented that wintering sage grouse primarily use sagebrush during the winter months. Any proposed type conversion which includes winter use areas must be carefully considered. Approval should not be given prior to an on the ground survey of sage grouse winter distribution during peak snow conditions. What may appear as an excess amount of sagebrush during summer months may provide only minimal amounts available above the snow for wintering birds. Known sage grouse wintering areas should receive priority attention in the control of wildfire.

Further consideration must be given to the subspecies of big sage to be burned. Artemisia tridentata vaseyana and Artemisia tridentata wyomingensis appear to be the most palatable while subspecies Artemisia tridentata tridentata is the least. Traditional winter use areas may be tied to brush subspecies. Further study should be conducted to determine the quantity and availability of the most palatable sagebrush on winter use areas.

On severely abused ranges where little or no understory remains, a rangeland drill is sometimes used for planting important sage grouse forbs such as alfalfa (Medicago spp.), yellow sweet clover (Melilotus officinalis), western yarrow (Achillea millefolium lanulosa), sainfoin (Onobrychis spp.), small burnett (Sanguisorba spp.), vetch (Vicia spp.), goatsbeard (Tragopogon spp.), chinese lettuce (Lactuca spp.), and dandelion. A crawler tractor with a trickle seeder ensures proper subsurface seed planting.

It must be recognized that when any of the above techniques are used in xeric 15-25 cm (6-10 in) precipitation zones, reseeding may be needed depending on existing seed sources, and overall response may be limited by precipitation patterns during the project year. In areas of 30 cm (12 in) or more precipitation, reseeding will probably not be necessary depending on range conditions.

Sources of seed for rangeland rehabilitation are more readily available than they were 10 years ago and the use of desirable forbs in range rehabilitation projects should be encouraged. Budgeting must allow for the purchase of forb and brush seed if sage grouse habitat enhancement is to be realized. Local seed is usually better than that from other areas.

Livestock Relationships

Domestic livestock grazing generally represents the dominant use of western rangelands. To protect and enhance sage grouse habitat in concert with livestock grazing, we present the following observations and recommendations.

Mesic sites (streams, springs and associated meadow-type vegetation) provide critical habitat, both seasonally and yearlong, for sage grouse. The

critical nature of upland meadows in Nevada as brood rearing areas for sage grouse was documented by Savage (1969) and Oakleaf (1971). Oakleaf (1971) stated:

> "The upland meadow represents the primary summer habitat available to sage grouse throughout much of its range in Nevada. Past and present management of public lands in Nevada has regarded upland meadows as sacrifice areas. A serious deterioration of this habitat has been the inevitable result and will continue unless meadows are specifically managed."

Savage (1969) determined that "meadows provided a source of food (forbs), water and cover that were unavailable on more xeric, but adjacent rangelands".

Oakleaf (1971) showed that a reduction in meadow use by sage grouse occurred as an increasing percentage of the juvenile population reached 11 to 12 weeks of age. He further found that the diminished food supply of a deteriorated meadow limited associated use by sage grouse.

The use of mesic sites by domestic livestock is well documented. Stoddart and Smith (1955) found that valley bottoms and areas around water sources are used first by cattle. They indicated overgrazing of mesic sites was necessary to force cattle to use less accessible, rougher terrain. The result is that mesic sites become sacrifice areas.

In the report "Effects of Livestock Grazing on Wildlife, Watershed, Recreation, and Other Resource Values in Nevada" - the Nevada Report (USDI 1975), the Bureau of Land Management identified livestock grazing as having an adverse impact on 1,413 km (883 mi) of streambank riparian habitat in Nevada. This report also described the combined effects of water development practices and livestock grazing as being the primary areas where wildlife habitat conflicts exist, and further states that "The areas around most livestock waters and water courses visited (in the 3 districts) were denuded of vegetation and trampled by livestock".

In summary, mesic sites constitute key sage grouse habitat and also provide both water and forage for domestic livestock. In many instances mesic and riparian vegetation provide cover in the form of shade for cattle and domestic sheep. Mesic sites serve as focal points of livestock use and distribution, but in terms of forage produced and acreage involved, these sites constitute only a small portion of the western rangeland.

The timing of livestock use on meadows dictates whether direct competition exists with sage grouse, although heavy continual use has and will continue to cause total destruction of meadows. Forbs and insects are important to chick survival and growth from the time of hatching in early June until early August.

Although fencing may not be the best management practice, especially in areas of limited water availability where mesic sites are also important to antelope and/or deer; until innovative range management strategies provide for riparian areas, fencing may be the only solution to prevent the loss of these key habitats. One technique for protecting meadow forbs from livestock trampling and grazing is to fence the stream meadow and leave fence gaps to provide livestock access to water (Figure 2). Grazing may be allowed after mid-August depending upon the condition of the meadow and the precipitation zone. It may be that grazing should be allowed only once every 3 or more years on meadows in poor condition or in the 15-25 cm (6-10 in) precipitation zone. In 30 cm (12 in) zones, annual August grazing could probably be allowed, once adequate vegetative cover has become reestablished and the water table is adequate.

A problem could arise in administering the opening and closing of meadow gates. A cooperative agreement should be written between the state wildlife agency and the land management agency to coordinate this responsibility. Enforcement should also be coordinated.

Water development has been another area of conflict. Marginal springs

In summary, mesic sites constitute key range browse habitat and also provide both water and forage for domestic livestock. In many instances mesic and riparian vegetation provide cover in the form of shade for cattle and domestic sheep. Mesic sites serve as focal points of livestock use and distribution, but in terms of forage produced and acreage involved, these sites constitute only a small portion of the western rangeland.

The timing of livestock use on meadows dictates whether direct competition exists with sage grouse, although heavy continued use has and will continue to cause total destruction of meadows. Forbs and insects are important to chick survival and growth from the time of hatching in early June until early August.

Although fencing may not be the best management practice, especially in areas of limited water availability where mesic sites are also important to antelope and/or deer, until innovative range management strategies provide for riparian areas, fencing may be the only solution to prevent the loss of these key habitats. One technique for protecting meadow forbs from livestock trampling and grazing is to fence the stream meadow and leave fence gaps to provide livestock access to water (Figure 2). Grazing may be allowed after mid-August depending upon the condition of the meadow and the precipitation zone. It may be that grazing should be allowed only once every 3 or more years on meadows in poor condition or in the 15-25 cm (6-10 in) precipitation zone. In 30 cm (12 in) zones, annual August grazing could probably be allowed, once adequate vegetative cover has become reestablished and the water table is adequate.

A problem could arise in administering the opening and closing of meadow gates. A cooperative agreement should be written between the state wildlife agency and the land management agency to coordinate this responsibility. Enforcement should also be coordinated.

Water development has been another area of conflict. Marginal springs

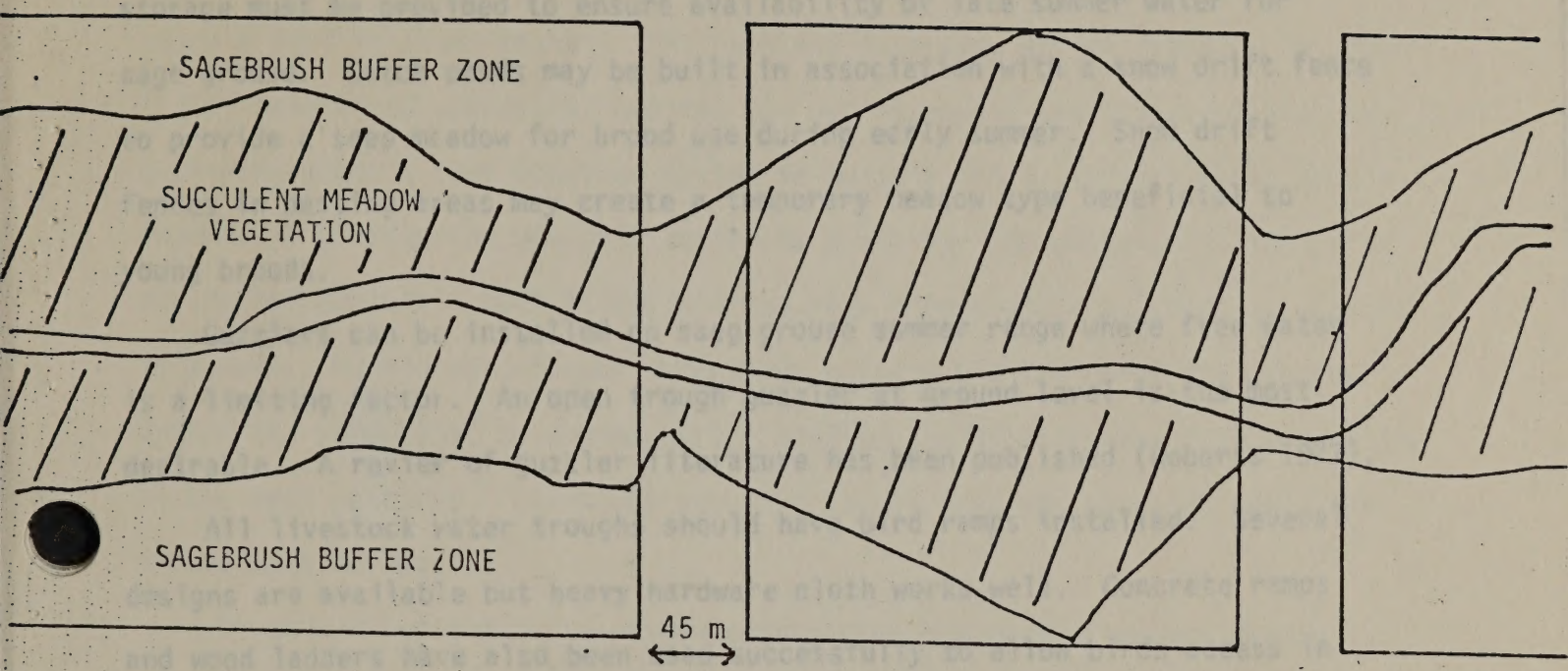
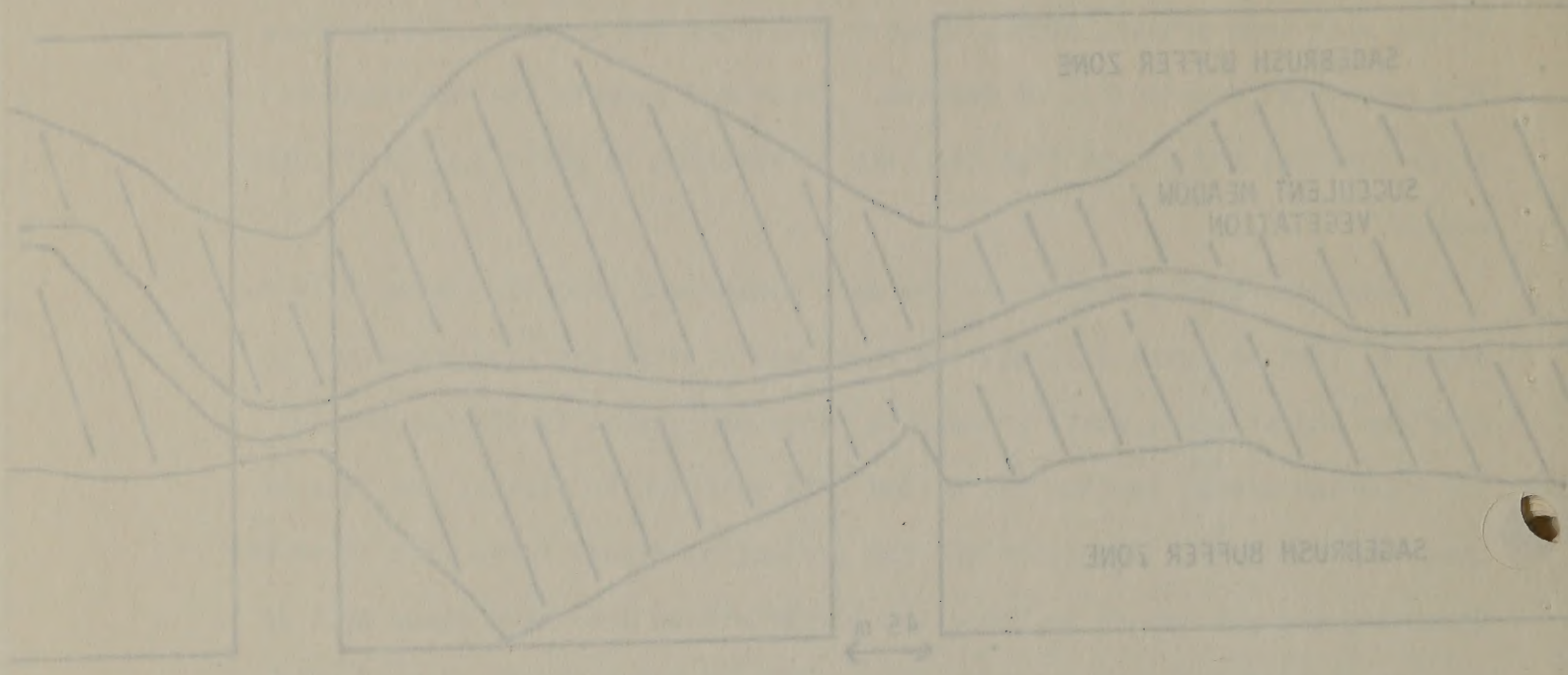


Fig. 2. Stream meadow fencing allowing livestock access to water.



and seeps which may be endangered by development should not be disturbed. In brood rearing areas springs and attendant meadow vegetation should be fenced and water piped to an outside stock tank with an atmospheric valve system. When the tank is full, water should be allowed to overflow into the fenced meadow.

Reservoirs should be fenced and the water piped to a trough. Dead storage must be provided to ensure availability of late summer water for sage grouse. Catch ponds may be built in association with a snow drift fence to provide a seep meadow for brood use during early summer. Snow drift fences in nesting areas may create a temporary meadow type beneficial to young broods.

Guzzlers can be installed on saeg grouse summer range where free water is a limiting factor. An open trough guzzler at ground level is the most desirable. A review of guzzler literature has been published (Roberts 1977).

All livestock water troughs should have bird ramps installed. Several designs are available but heavy hardware cloth works well. Concrete ramps and wood ladders have also been used successfully to allow birds access in and out of the troughs. It is more desirable for sage grouse and other birds and small mammals to develop a tank overflow system which provides water in a ground level drinker. The BLM policy manual states water systems used by livestock will be left on for wildlife use even when livestock have been moved. Turning off water sources continues to be a problem in some areas.

Direct competition frequently results when winter and spring sheep range and sage grouse wintering and brood use areas overlap. Managers should evaluate these situations and recommend alternate grazing sites where competition with and overuse by domestic livestock exists.

Grazing Systems

The heavy use pasture in rest rotation grazing systems continues to be a source of concern for sage grouse managers. When this pasture encompasses nesting and/or brood rearing habitats the results are negative. In North Dakota, Christenson (1971) reported that hatching success in sharp-tailed grouse (Pedioecetes phasianellus) was reduced by livestock trampling and removing cover. A similar problem was noted by Yde (1977) for sharp-tails using a rest rotation pasture that received intensive spring grazing. Nielson (1978) determined sharp-tail habitat was not improving and the population was declining under a rest rotation system in Montana where carrying capacity was determined by figuring 55% utilization of grass for the whole unit, including the rested pasture. Neel (1980) studied sage grouse and rest rotation grazing in Nevada. He did not discuss impacts on nesting but indicated the grazing system was beneficial to brood rearing habitat due to increased forb production in the rest pastures. Livestock were not turned into the pastures until the second week in June.

It is not legitimate to assume sage grouse can move elsewhere during heavy livestock use. Their use patterns have developed over long periods and traditional habitat areas have proven to be the best available for the welfare of the population. The impact of sudden heavy livestock use on traditional sage grouse habitat is deleterious. More studies are needed to document the obvious effects of rest rotation grazing systems on sage grouse. Until further information is available, use should not exceed 50% of the forage in any pasture.

Livestock Drives

The forced movement of cattle and sheep across the range is commonly practiced, particularly during spring and late fall. Concern is expressed regarding the impact on nesting hens and young broods in the path of such drives. It is known that hens abandon nests with little provocation while

laying (mid-April through early May). It is alsc known that yearling hens are prone to nest atandonment when disturbed, even during incubation. Since yearling hens comprise about 35% of the reproductive segment, the impact of livestock drives could be severe. Known nesting areas (3.2 km (2 mi) radius from leks) should be undisturbed from mid-April to mid-June.

INDUSTRIAL DEVELOPMENT

The renewed interest in mining and energy related development has created a threat to wildlife not considered 10 years ago. Wildlife which rely on sagebrush habitat are vulnerable as demonstrated by the losses associated with the Jim Bridger coal-fired power plant in southwestern Wyoming. Since sage grouse and pronghorn (Antilocapra americana) often share the same habitat the following section on precluding or mitigating sage grouse habitat loss associated with energy development is similar to that found in the "Guidelines for the Management of Pronghorn Antelope" (R. Autenrieth ed. 1978).

1. Overview: Local, state, provincial, and federal regulatory and management agencies should jointly develop regional priorities for areas that should and should not be developed to minimize the loss or serious disruption of important ecosystems within each region.

   Goals -- Post-development land-use goals should include a commitment to maintain the production of sage grouse as an integral part of the development plan for each lease, both on public and private lands that supported sage grouse prior to development.

Steering Committee -- Establish a steering committee directed by the State or Provincial Wildlife Management Agency, and composed of involved members of industry, federal, university, and interested citizen groups, organizations or agencies as needed. The committees should be established on a regional basis within each state to provide guidance and advice for developing the post-development land-use goal and basic strategies for accomplishing them on each lease site.

Lead Time -- Specific industrial developments and the related informational needs of sage grouse populations and their habitat should be identified early enough to allow sufficient lead time for seasonal field work, budgeting, personnel assignments, and for review by the State or Provincial Wildlife Management Agency.

2. Pre-development Surveys: Before developing and completing an energy development plan, industry should work with wildlife agencies to quantitatively identify, describe, and map the quality and extent of key ranges; sage grouse habitats; sage grouse distribution and movement patterns; associated recreation and economic values; and baseline habitat/vegetative data for sage grouse. These parameters should be monitored throughout the life of the development. Study plans and progress must be directed and approved by the responsible State or Provincial Management Agency.

3. Definitions and Requirements:

Key Areas -- Key areas for sage grouse are defined as those portions of the habitat contained within the distributional extent of a population which are necessary to maintain and perpetuate the population. Included are winter ranges, breeding complexes, brood rearing areas and water sources.

Sage Grouse Population Characteristic Descriptions -- Industry

should compile information on previous census work in the general area of the project site. They should conduct lek counts and surveys, summer production surveys and winter counts and surveys on and adjacent to the project site during pre-development and development phases to identify population status and trends.

Population parameters including: 1) extent of occupied habitat; 2) leks; 3) nesting habitat; 4) brood rearing areas; and 5) wintering areas, should be described and documented. Previous population estimates and trends should be determined from reliable sources. Predevelopment breeding population estimates should be obtained using standard techniques. Factors that affect populations such as habitat, weather, private landowner tolerance, hunting pressure, distribution of hunters and hunter access should be identified.

Recreation and Economic Value -- The recreational value of the sage grouse populations to be impacted should be described and calculated considering both nonconsumptive and consumptive uses, land status adjacent to the project site, hunter and observer access, hunting quality and annual sustained harvest.

Premining Baseline Vegetative Data -- Qualitative and quantitative vegetative type maps of the development areas should be prepared prior to development. Maps should be on a scale of 1:24000, and should be used as a basis for reclamation goals and plans. Vegetation data should include a list of plant species and plant communities present as well as community diversity. Quantitative data on the plants should include percent canopy cover, plant density and frequency and annual production by major species. Key species of plants important for sage grouse should be

identified in relation to season of use.

Based upon the vegetative type mapping, the actual and potential new sage grouse habitat within the development area should be delineated.

4. Map Standards: Maps of each project site should be drawn at a scale of 1:24000. Maps of the entire range of the populations affected by each specific development should be drawn at a smaller scale, preferably 1:126,720 (½ inch/mile).

U.S. Geologic Survey maps of a scale of 1:24,000 are recommended for project site mapping. Critical sage grouse areas affected by the project should be mapped using a smaller scale, preferably ½ inch/mile. Mapping critical range distribution and movement only on the project site is not sufficient to portray the influence of the project on the population.

5. Protection Measures:

- Basic Considerations -- Specific areas identified as critical for the maintenance and perpetuation of a population, and which are difficult areas to duplicate, should receive top priority and where possible remain unaltered and available for use by sage grouse populations.

Controlling Access and Disturbance

a. County land use planning for ancillary developments (housing, shopping centers, recreational facilities) should site such developments away from key sage grouse areas so as not to create undue disturbance.

b. Maintain existing public access and where desirable, provide additional access to public lands through private mining lands.

c. Consolidate development access and operations roads and keep

to the absolute minimum.

d. Locate required roads and railroads on the periphery of or away from sage grouse use areas.

e. Restrict human activities to essential development-related efforts to prevent unnecessary disturbances to sage grouse.

f. Prohibit or minimize disturbance of critical areas.

g. Use only the absolute minimum acreage for exploration and drilling and use techniques that create the least amount of activity and disturbance.

h. Employ a unified, consolidated storage area for all development and drilling equipment and materials.

i. Maintain a buffer zone of 3.2 km (2 mi) between development activities, breeding and wintering complexes.

6. Predator Control and Law Enforcement:

a. Control free-ranging dogs all year where deemed necessary by the State or Provincial Wildlife Management Agency on occupied sage grouse range.

b. Intensify law enforcement activities on occupied sage grouse ranges in the development areas.

7. Mitigation, Reclamation and Habitat Enhancement:

Basic Considerations

a. Control all impacting actions (post-development land-use emissions, discharges, effluents) to provide a post-development level of sage grouse habitat approximating or surpassing predevelopment conditions. Strategies for achieving this (i.e.--increased carrying capacity through fertilization of range, water development, livestock management, purchase of private lands by public agencies) should be detailed in formal plans (i.e.--development plans, Management Framework

Plans, State or Province Comprehensive and Operational Plans).

b. Key areas lost during development should be mitigated by developing sites on adjacent areas having enhancement potential when such enhancement is deemed feasible with reference to the probability of displaced sage grouse using the alternate site. A major goal should be the attainment of a close juxtaposition of sage grouse habitat elements (food, cover, water) both during and after development.

c. Consider priorities for revegetation on the basis of critical quality values (i.e.--nutritional values, palatability, cover needs) in the habitat reclamation plans.

Physiography--Shape the disturbed areas into terrain that enhances sage grouse use, i.e., no cliff walls. A gently undulating terrain is best.

Water

a. All water discharges and effluents of acceptable quality resulting from development activities should be made available for sage grouse use and should create protected meadows for brood use.

b. Develop additional sources of strategically located water (ponds, springs, streams, guzzlers) on areas actually or potentially occupied by sage grouse. Also develop alterrate water sources in areas where toxic waste waters (cyanide ponds, etc.) may be the only available water.

Vegetation

a. Reclaim habitat to resemble shrub steppe-grassland or the vegetative community which existed prior to development. Any reseeding mixtures should include native forb and brush

species important to sage grouse.

b. If the approved post-development land-use is agricultural production (i.e., wheat, alfalfa, etc.), restrict field sizes to a minimal acreage ard intersperse them among islands of native vegetation.

c. Regulate domestic livestock use on reclaimed areas to promote ecological succession that will benefit sage grouse populations.

d. Habitat lost to development and post-development land-use should be mitigated by reducing competition with domestic livestock on adjacent, nondeveloped lands.

Hazards--Remove from sage grouse range all unused mining equipment, hardware, wire, pipe, barrels, toxic substances, etc., which might constitute a hazard to sage grouse or their activities immediately after the cessation of development operations.

Management

a. Regulate wildlife population numbers on reclaimed areas to insure successful reclamation through cooperation with the State or Provincial Wildlife Management Agency.

b. Purchase easement to "land locked" public lands (i.e., by use of mineral severance taxes, by including in lease stipulations, etc.).

c. Transplant and restock sage grouse when deemed desirable and feasible by the State or Provincial Wildlife Management Agency.

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APPLICATION OF REMOTE SENSING FOR SAGE GROUSE MANAGEMENT IN SOUTH DAKOTA

By

R. G. Best, T. Bailey, H. Haivala and T. Schenck

ABSTRACT

South Dakota has a small huntable population of sage grouse in the western counties. Only a limited amount of data is available on sage grouse habitat or the factors limiting the population and distribution of sage grouse in South Dakota. The objective of this project is to evaluate the use of remotely-sensed imagery in sage grouse management programs. Sagebrush is a primary component of both nesting and brooding habitat and winter habitat. Field data, including crown coverage, density and height and breadth, of sage brush were collected within a 3 Km radius of known active leks. These data not only determine sage grouse habitat usage, but also will affect the appearance of the habitat on imagery. Ground level color-infrared photos illustrate the lack of a characteristic red reflectance for big or silver sage brush. Sagebrush/grassland communities can most accurately be interpreted on color-infrared aerial photography collected during vegetative "peak green" at scales 1:20,000 or greater. A sage grouse management potential map based on interpretations of land use and ownership from small scale imagery was prepared for Harding County, South Dakota. Interpretations of winter Landsat imagery confirmed that winter habitat may be a major limiting factor for the sage grouse population in South Dakota.

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SAGE GROUSE HABITAT SELECTION IN NORTH PARK, COLORADO

THOMAS J. SCHOENBERG, Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins 80523.

ABSTRACT: Seasonal habitat use of 16 male and 22 female radio-marked sage grouse (Centrocercus urophasianus) was studied from mid-April, 1979 to early August, 1980 in North Park, Jackson County, Colorado. Sagebrush (Artemisia tridentata) canopy cover, plant dimensions (length, width, height), and intercept distance were greater ($P < 0.05$) at sage grouse winter feeding-loafing (F-L) sites than at any of the breeding season F-L sites. Habitat parameters at nest sites and winter F-L sites were not different ($P > 0.05$) but averaged lower at nest sites. Comparison among breeding season sites indicated that nest sites were structurally the most distinct and had the greatest average sagebrush canopy cover, plant dimensions, and intercept distance. Comparison of these habitat variables among the other breeding season sites indicated that F-L sites of males and unsuccessful hens were fairly similar to each other as were pre-incubation F-L sites and brood-rearing sites. Only leks had lower ($P < 0.05$) average values of these habitat parameters than random sites. There were no differences ($P > 0.05$) in forb or grass cover, grass height, and cover of dandelion (Taraxacum officinale) or clover (Trifolium hybridum) among sites used by broods, unsuccessful hens, and males in meadows in summer. Sagebrush plant dimensions were the most important habitat variables distinguishing among sites in discriminant function and principal components analyses. Due to large variance within sample sites, however, only 43% of the sites were correctly classified in discriminant function analysis. Principal components analysis provided more interpretable functions and ordination of sites than discriminant function analysis.

Presented at 12th Biennial Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, North Dakota.

SUMMER USE BY SAGE GROUSE OF IRRIGATED AGRICULTURE IN SOUTHEAST IDAHO.

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Abstract

A three summer study of sage grouse use of irrigated agriculture in southeast Idaho was initiated in May, 1980. The study area is located along a 12 km interface of sagebrush-grass range and irrigated agriculture in the northwest corner of the Idaho National Engineering Laboratory (INEL)site. Weekly trends in the number of grouse using the agricultural area were followed by weekly counts along a 12 km census route during the summers of 1980 and 1981. Grouse were first observed on the census route on 3 June in 1980 and on 12 June in 1981. Broods were first observed on 17 June in 1980 and on 18 June in 1981. Census route counts were highly variable from week to week. Moving 3-point averages of the highest weekly counts eliminated some of the variation and revealed a consistent trend in the numbers of grouse observed through the first week of August in 1980 and 1981. There was a steady increase in the average number of observations until mid-July after which there was a steady decline through early August. The 1980 counts averaged higher than 1981 counts in spite of better production estimates in 1981. June and July brood sizes averaged 4.09 (n=32) in 1981 and 3.17 (n=30) in 1980. Twenty three per cent of hens observed in 1981 had broods, 14% of hens were with broods in 1980. Higher 1980 counts may have been due to an early influx of a greater number of broodless hens in 1980 than 1981.

Three of 8 radio-marked grouse captured on strutting grounds 6-10 km south of the study area were known have moved to irrigated fields during the summer of 1981. Three hens radio-tagged in 1980 showed fall movements of 6.4, 15.5,

and 17 km south of the agricultural area. Four grouse captured during the summer of 1981 had home ranges of 14, 70, 104, and 134 ha during June and July. Radio-tagged grouse were located 91 times in July- Sept., 1980 and June and July, 1981. Forty (44%) of the locations were in alfalfa fields, 39 (43%) were in sagebrush habitat, 9 (10%) were in pasture, and 3 (3%) were in small grain. Relative use of habitat types varied with time of day. Alfalfa fields were the most preferred field type during any time period.

Abstract

WINTER FLOCKING BEHAVIOR AND HABITAT USE BY SAGE GROUSE IN SOUTHEASTERN IDAHO

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The Idaho National Engineering Laboratory (INEL) site in southeastern Idaho supports large wintering concentrations of sage grouse (Centrocercus urophasianus). Winter flocking characteristics and habitat use by sage grouse in this area are discussed. Both flock composition and cover type had a significant effect on sage grouse flock size ($P<0.01$). Mixed sex flocks were larger than male or female flocks. Further, flocks occurring in a low sagebrush (Artemesia arbuscula) cover type were larger than those in big sagebrush (A. tridentata) cover types. Most sage grouse remained in segregated flocks throughout the winter; mixed sex flocks never comprised more than 16% of all flocks recorded during any winter month. During the three years of the study, 1 winter was relatively severe and the other 2 were relatively mild. Sage grouse flocks tended to be larger in the big sagebrush cover types and smaller in the low sagebrush cover types during the severe winter. However, these differences were not statistically significant ($P>0.05$). Regression analyses did not suggest that any single environmental variable (snow depth, temperature, sagebrush density, sagebrush canopy coverage, or sagebrush height) had a strong influence on flock size. Multiple regressions also indicated that snow depth and mean daily temperatures had little effect on size of male, female, or mixed sex flocks. Sage grouse did not show a strong flocking response to increasingly severe winter weather. Instead, grouse moved to areas of denser and taller sagebrush as weather conditions became more severe.

Sage grouse winter use sites had a higher density and lower height of sagebrush than did areas that were not used. Sage grouse winter range was generally characterized by a density of 2 to 4 sagebrush plants/m^2, 10 to 30% canopy coverage, and a mean sagebrush height of less than 40 cm.

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TECHNIQUES FOR TRAPPING SAGE GROUSE IN COLORADO

KENNETH M. GIESEN and CLAIT E. BRAUN, Colorado Division of Wildlife, 317 W. Prospect, Fort Collins 80526, and THOMAS J. SCHOENBERG, Department of Fishery and Wildlife Biology, Colorado State University, Fort Collins 80523.

ABSTRACT: During 1963-80, 6,231 sage grouse (Centrocercus urophasianus) (5,147 adults, 1,084 juveniles) were captured and banded in Colorado. Most (5,752) have been banded since 1973. Four trapping methods were evaluated for capture efficiency (spotlighting, drive traps, stationary cannon nets and vehicle-mounted cannon nets) between 1977 and 1980 during which 1,954 grouse were captured. Spotlighting resulted in most captures (1,317; 67.1%) followed by drive trapping (353; 18.1%), vehicle-mounted cannon nets (228; 11.7%) and stationary cannon nets (61; 3.1%). Spotlighting was least selective for age or sex of birds trapped except when trapping on leks. Drive trapping and both methods of cannon netting were selective for juveniles. Trapping mortality was < 1.0% for all trapping methods with injuries most common in drive trapping and cannon-netting.

Presented at 12th Biennail Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, North Dakota.

EFFECTS OF SAGEBRUSH ERADICATION ON SAGE GROUSE IN SOUTH CENTRAL UTAH

George W. Enyeart

North Dakota Game & Fish Department

A four-year study was initiated on the 34,670 acre Pines study area in 1951. Sagebrush eradication and range reseeding may be beneficial in creating more varied feeding areas. It has a detrimental effect in that it reduces or eliminates sagebrush cover. It is recommended that such programs be done in a series of steps and that strutting grounds as well as an area of adjacent sagebrush cover be left undisturbed.

WINTER NUTRITION OF SAGE GROUSE IN NORTH PARK, COLORADO

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ABSTRACT: Sage grouse (Centrocercus urophasianus) winter food habits and the nutritional value of sage grouse foods were studied during winter 1980-81 in North Park, Colorado. Feeding flocks of sage grouse were located by radio-telemetry. Observations, vegetative measurements, and bird collections were made at feeding sites. Sagebrush (Artemisia spp.) on vegetation transects was identified to species by morphological characteristics and tentatively to subspecies by the fluorescent pattern of a water extract of crushed leaves. Mean height (17 cm, range 8-33) and stem diameter of sagebrush at feeding sites were lower ($P < 0.05$) than mean height (25 cm, range 8-33) and stem diameter of sagebrush at random sites. Mean canopy cover and percent foliation of sagebrush did not differ between feeding and random sites ($P > 0.05$). Species composition of sagebrush differed (chi-square, $P < 0.005$) between feeding and random sites. Wyoming big sagebrush (Artemisia tridentata wyomingensis), mountain big sagebrush (A. tridentata vaseyana), and alkalai sage (A. longiloba) comprised 61, 34, and 5% respectively of the plants encountered on random transects and 83, 15, and 3% respectively of the plants encountered at feeding sites. Silver sage (Artemisia cana viscidula) is present in the study area but was encountered on only 1 random transect. Wyoming big sagebrush was the only species/subspecies present on 67% of the feeding transects. Where both subspecies of big sagebrush were found, leaves of Wyoming big sagebrush were highly preferred as food (chi-square, $P < 0.005$). Sage grouse were observed feeding on alkalai sage only once, but on this transect it accounted for most (69%) of the fed upon plants. Ninety-five percent (35 of 37) of sage grouse crops and gizzards examined contained only big sagebrush. One crop contained alkalai sage while another, from a bird shot in early spring, contained some green forb material. Selection within feeding areas was evident. Mean values of fed upon plants differed ($P < 0.10$) from mean values of non-fed upon plants in just over half (52%) of the 21 feeding transects in either percent foliation, height, or stem diameter. These differences were not related to selection for species or subspecies of sagebrush. Nutritional analyses of sagebrush samples, when completed, may provide an explanation.

Presented at 12th Biennial Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, North Dakota.

A B S T R A C T

Use of Interest Money to Preserve Sage Grouse Strutting Grounds

by

Daniel D. Schmidt, August 31, 1981

Spearheaded by the United Sportsmen of North Dakota, a petition drive began in March of 1978 which successfully returned the use of the interest revenues generated by the Department's reserve fund money to the Department. Until this time these interest funds were diverted to the State's General Fund. The state legislature earmarked some of these funds for development and enhancement of wildlife habitat on private land.

At the request of the Department's Upland Game Supervisor, a portion of these funds were directed toward preserving sage grouse strutting grounds that are being disrupted or are in danger of being disrupted. An inventory of "endangered" strutting grounds was made and prioritized. The Department has contacted the landowners and is working with them to maintain or re-establish these grounds. Several approachs tc management are being used or investigated including easements, restricted use agreements and reseeding of native grasslands.

DISPERSAL OF SAGE GROUSE FROM THE TEST REACTOR AREA OF THE IDAHO NATIONAL ENGINEERING LABORATORY

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Abstract

A study of sage grouse summering on the Test Reactor Area (TRA) of the Idaho National Engineering Laboratory (INEL) was initiated in July, 1980. One of the study objectives is to determine dispersal and migration from the TRA. Eleven adult hens and 2 juvenile hens were fitted with radio transmitters. Summer home ranges of radio-marked grouse averaged 46.8 ha. Some grouse began moving away from the TRA during the first week of September. By 23 September all radio-marked grouse had moved over 1 km away from the TRA. Movements to winter areas ranged from 4.2 to 34.5 km with a mean of 11 km. A mean winter range of 3111 ha was calculated for 3 adult hens followed through February, 1981. Two of the adult hens returned to the TRA during the summer of 1981 representing round trip distances between winter and summer ranges of 28 and 68 km. Three others (2 adults and 1 juvenile) returned to areas near TRA but soon moved off to alfalfa fields west and north of the INEL representing yearly movements of 20 to 26 km.

PRELIMINARY OBSERVATIONS ON USE OF SOLAR-POWERED RADIO TRANSMITTERS ON JUVENILE SAGE GROUSE

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ABSTRACT: As part of a study of sage grouse dispersal, 13 solar-powered radio transmitters (148 MHz) were placed on juvenile sage grouse between 14 July and 12 August 1981 on Cold Spring Mountain, Moffat County, Colorado. Transmitters and poncho mounts weighed an average of 22 g or 2.9% and 3.0% of average body weights at time of capture for radio-marked males and females, respectively (6 males, 7 females). During 150 reobservations from 14 July to 28 August, poncho-mounted transmitters did not noticeably affect behavior. Two radio-marked birds recaptured 1 and 6 days after radio-marking appeared normal. The bird recaptured after 6 days was killed by a predator 12-18 days after transmitter attachment. Maximum signal range using 3 element Yagi antennas was at least 7.25 km, while average range was 1.0 km. Radios began transmitting 15 minutes before sunrise and stopped 15 minutes after sunset, depending on weather and cover.

Presented at 12th Biennial Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, North Dakota.

Reclamation of Sage Grouse Habitat - Suggestions for Surface Coal Mines[1]

The initial step to successful habitat reclamation is to assess the pre-disturbance sage grouse use on an area. Reclamation priorities can then be based on critical habitat value, planned land use, reclamation potential, and costs. Revegetation plans for sage grouse habitat should include big sagebrush in shrubland mosaics, and forbs in seed mixes. Other methods to encourage reestablishment of native plants, such as native vegetation mulch and transplants, could be explored.

[1] Presented by Bonnie C. Pcstovit, ARCO Coal Creek Mine, P.O. Box 546, Wright, WY, 82732,
At 12th Biennial Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, N.D.

SAGE GROUSE POPULATION TRENDS AND DYNAMICS IN COLORADO

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ABSTRACT: Intensive studies of sage grouse (Centrocercus urophasianus) in Colorado were conducted in Jackson (North Park) (1973-81) and Moffat (1976-81) counties in recent years. Objectives have included documentation of trends in population levels, estimation of survival and turnover rates, and estimation of the annual (direct) rate of harvest. Techniques used included counts of males on leks in spring (late March - late May), trapping and banding, and collection of harvest statistics through check stations, volunteer wing collection barrels, hunter permits and band recoveries. Peak counts of males on leks in North Park varied from 28 to 33 males/lek from 1973 to 1977 and from 39 to 43 males/lek from 1978 to 1981. In Moffat County, average number of males counted on leks increased from 32 in 1976 to 53 in 1979 and decreased to 29 in 1981. Stability of counts of males on leks in North Park appeared to be unaffected by production of young while those in Moffat County were somewhat affected by production of young. Estimated annual mortality of adult males averaged 51.9% in North Park (7-year average) and 50.3% in Moffat County (5-year average). Average annual mortality rates for adult females were 41.2% in North Park and 41.5% in Moffat County (7- and 5-year averages, respectively). Hunting removed from 7.0 to 10.9% of the fall population of sage grouse in Moffat County (3 years of data) and from 6.9 to 11.5% in North Park (8 years of data). Changes in bag and possession limits (2 and 4 to 3 and 6) and season length (3 to 25 days) had no measurable effect on harvest rates of sage grouse.

Presented at 12th Biennial Western States Sage Grouse Workshop, 1-3 September 1981, Bowman, North Dakota.

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